with the general mathematical theory of electromagnetic waves, with special reference to transmission and telephone lines, and in the sixth chapter Hertzian telegraphy is briefly discussed from the practical side. The next two chapters, forming the second part of the volume, deal with harmonic analysis and non-harmonic E.M.F.'s and currents, and bear directly on the problems met with in alternating-current machinery. The mathematics is advanced, and the book is only suitable for advanced students. In an appendix are given eighty-eight problems for the student to work out, and there are a number of very excellent diagrams.

(2) Prof. Kennelly describes his book as an elementary treatise; it covers both the theoretical and practical side of wireless telegraphy and telephony, and is admirably suited for the reader with only very slight technical knowledge. The exposition of the theoretical side is clear, and the description of practical methods, though short, is sufficient to give a general idea of the present position of the art. The only objection which we have to raise against the book is on account of the diagrams, which are numerous but far from clear. Those in the earlier part of the book especially are on so small a scale that they are practically unintelligible; this is the more to be regretted as the type and paper are excellent, and there is no apparent reason why the diagrams should not be equally well reproduced.

(3) Dr. Erskine-Murray's little book is a popular exposition of the methods and present position of wireless telephony. Dr. Erskine-Murray combines a thorough knowledge of his subject with the power of clear and simple explanation, and we know of no better book for those of the general public who are anxious to know how wireless telephony now stands. We are rather doubtful whether the somewhat rosy view of the future taken in the last chapter is likely to be realised, although the advances already made make one chary of expressing too strong a doubt.

(4) No stronger evidence of the assured position of wireless telegraphy as a commercial means of communication could be afforded than the publication of this little Government handbook. The book itself does not call for much comment, since it contains only instructions and regulations for operators on board ship or in coast stations, but that such regulations should be called for is a more convincing proof that wireless telegraphy has settled down to the steady enjoyment of its own kingdom than any number of treatises or popular booklets. The position of wireless telephony to-day is much the same as that of wireless telegraphy ten years ago. Will 1920 see the issue of a Government handbook for wireless telephone operators?

OUR BOOK SHELF.

The Liverpool Geological Society. A Retrospect of Fifty Years' Existence and Work. By W. Hewitt. Pp. 117. (Liverpool: C. Tinling and Co., Ltd., 1910.)

THE Liverpool Geological Society, which was established on December 13, 1859, has signalised its jubilee by the publication of this volume, which includes an account of the history of the society and its geological labours, a list of papers printed in the Proceedings, and biographical notices of some past members. The society originated from a meeting held at the residence of G. H. Morton, who was its real founder, and for about forty years the chief moving spirit among the members. A capital portrait of him is given. Well known as the author of a volume "On the Geology of the Country around Liverpool," and of a series of important papers on the stratigraphy and palæontology of the Carboniferous rocks of Flintshire, he was one of the most distinguished of provincial geologists. By regarding the country within fifteen miles of Liverpool as their proper sphere of study, the society took the Carboniferous limestone series of Flintshire as their foundation-rocks, together with the succeeding Millstone Grit, Permian, Trias, Pleistocene, and Recent deposits.

On all these formations the members of the society have done excellent work. Undoubted Permian strata, including a bed of magnesian limestone with Schizodus, were described by Mr. E. Dickson at Skillaw Clough, near Parbold. The researches of the late T. Mellard Reade on the Triassic rocks, the Glacial Drifts, and the recent physical changes in the Lancashire district are well known. His portrait is included; also that of Dr. Charles Ricketts, another enthusiastic worker who dealt with many local physical problems. There is one other portrait, that of Joseph Lomas, who had done much in investigating the fauna, flora, and origin of the Trias. Unfortunately, a railway accident in Algeria terminated the life of this zealous and genial worker at the early age of forty-eight. Photographic plates are given of the famous footprints of Cheirotherium from the Keuper Sandstone of Storeton, in Cheshire, described by Morton; and of the gypsum boulder from the Glacial Drift of Great Crosby, described by Mellard Reade. The volume has been carefully prepared, and is a valuable and interesting record of the work of Liverpool geologists.

Catalogue of the Lepidoptera Phalaenae of the British Museum. Vol. ix. Catalogue of the Noctuidæ in the Collection of the British Museum. By Sir George F. Hampson, Bart. Pp. xv+552; plates cxxxvii-cxlvii. (London: Printed by Order of the Trustees British Museum [Natural History]; Longmans and Co.; B. Quaritch; Dulau and Co., Ltd., 1910.) Catalogue 15*s.*; plates, 12*s.*

WE have again to congratulate the authorities of the British Museum and the indefatigable author on the appearance, within less than a year, of another volume of this highly important descriptive catalogue of moths. It is the sixth which has been devoted to the Noctuidæ, and is the third and last volume dealing with the great subfamily Acronyctinæ, of which 385 genera and 2288 species (a large proportion new) are described, and a great number illustrated in the three volumes devoted to the subfamily.

It may be useful to note that at the commencement of his work Sir George gave a table of fifty-two families of Lepidoptera, of which seven (families 33-39 inclusive) are butterflies, placed between family 32, Castiniadæ, and family 40, Euschemonidæ, the remaining forty-five families being moths. Of these, the first three, the Syntomidæ, Arctiadæ, and Agaristidæ, are described in the three first volumes of the work; while of the fifteen subfamilies into which the Noctuidæ are divided at the commencement of vol. iv., only the first four subfamilies have yet been dealt with. It therefore follows that the nine volumes which have hitherto appeared cannot be expected to represent a quarter, and perhaps not even a tenth, of the whole work, although

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many of the families of moths and the subfamilies of Noctuidæ still to be monographed are undoubtedly much less numerous in species than those already described.

When we consider how very few species of insects were known to entomologists a century, or half, or even a quarter of a century ago, the enormous increase in our knowledge of this subject within the last few years is simply marvellous, even to those who have witnessed, and to some extent kept touch with, its progress from day to day.

Report on the Poultry Industry in Belgium. By Edward Brown. Pp. viii+112. (London: National Poultry Organization Society, Ltd., 1910.) Price 1*s.* net.

IN 1906 and 1907 Mr. Brown visited America, Denmark, and Sweden to inquire into the methods followed in the poultry industry, and during last year he visited Belgium with a similar object. Probably in no country in the world is intense production more general than in Belgium, one consequence being that it supplies its own poultry and egg requirements, and is not dependent, like England, on imports from foreign countries; indeed, it has a surplus for export.

Although in some respects the conditions in Belgium resemble those obtaining in England, there is the fundamental difference that the Belgian farmer specialises in small animals, like poultry, rabbits, even in pigeons and cage-birds as a hobby, whilst the English farmer has gone in for larger stock. Poultry-farming pure and simple is not common. But everywhere Mr. Brown found that poultry figured as an adjunct to the farm, particularly on the small holdings. In some cases, indeed, land did not come under cultivation until it had been run over for some years by fowls, and fertilised by their droppings. Thus the Campine district, which extends from Malines east and north to the Dutch frontier, was at one time merely a sandy plain covered with fir trees. About thirty years ago the peasants began to raise chickens for sale to the fatteners; the industry spread, and now the trees are gone and the whole district is farmed. It would be interesting to know how many tons of purchased food were consumed per acre in effecting this change. Egg-production is stated to be the main object, and the birds are looked after by the women and children; the methods are, however, essentially simple, no more elaborate appliance being used than is absolutely essential.

The report contains a number of useful details, and concludes with a number of recommendations. The small holder in particular is urged to devote some, though not all, of his attention to poultry, and it is suggested that poultry-keeping should be encouraged on land at present waste. Various methods of management are also recommended.

Halley's Comet: its History, with that of other noted Comets, and other Astronomical Phenomena, Superstitions, &c. By Rev. John Brown. Pp. 52; illustrated. (London: Elliot Stock, 1910.) Price 1*s.* net.

As a useful collection of facts and references concerning Halley's comet this small volume will take a place in the mass of comet literature now appearing so profusely. It contains nothing startlingly novel, being, to a great extent, a compilation of interesting oddments gathered, with due acknowledgments, from various sources. In many places extraneous material is introduced, rendering the book perhaps more interesting, but less suitable as a precise account of what it presumes to deal with. The four illustrations are rather crude and of no especial interest.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Orientation of Crystals of Ice in a Flux of Heat.

IT was found by Forbes many years ago that the thermal conductivity of ice was better along the principal axis than at right angles to it. Straneo, in 1897, does not come to any definite conclusion in deciding that such is the case. It is well known, however, that the formation of surface ice by conduction always shows the principal axis of the crystals to be normal to the freezing plane, or, in other words, in the direction of the flux of heat from the underwater. Since ice is a better conductor of heat than water, it is to be expected that if any difference exists in the conductivity in the two directions, the ice crystal would form in such a way as to dissipate the heat more readily.

During the process of the formation of an ice mantle in a rather large Bunsen ice calorimeter, my assistant, Mr. F. H. Day, directed my attention to a rather interesting case, which, I think, proves the better conduction along the axis of the crystal. The bulb of the calorimeter was about two-thirds immersed in a freezing-point mixture. This particular calorimeter was unusually difficult to start, and always refused to freeze when ether was rapidly evaporated in it, or when a saline ice mixture was introduced. In consequence, our custom has been to add some liquid air or solid carbon dioxide, as most convenient at the time. In this case we used solid carbon dioxide. The undercooling must have been considerable around the inner glass tube, and a sharp temperature gradient resulted between the lower part of the glass and the walls of the calorimeter. Heat was flowing in from the freezing-point mixture, but near the surface the heat flowed in more rapidly around the exposed portion of the bulb. The ice formed as usual, but on withdrawing the calorimeter for inspection we found, growing out from the solid mantle of ice, long needles and thin plates, which were perfectly orientated along the lines of the flow of heat. The crystals near the top of the mantle were directed at an angle upwards, while those at the base were found normal to the mantle surface. Between these positions the crystals grew at a corresponding inclination to the mantle surface. This, I think, conclusively shows the path of best conductivity in the ice crystal to be along the principal axis.

H. T. BARNES.

McGill University, April 19.

Zeeman Effect of the Yellow Mercury Line λ 5770.

IT is well known that the separation of the mercury line λ 5770 in a magnetic field into a triplet is abnormal, inasmuch as the value of the ratio e/m of vibrating electrons is much greater than that obtained from experiments on kathode rays or from measurements of the Zeeman effect on other lines of mercury and of other elements. Lohmann first noticed that the line is separated into a nonet in strong fields, but did not investigate its type. By using an echelon spectroscope of resolving power 430,000 for $\lambda=0{\cdot}5\mu$, I found that the distribution of lines in the nonet can be accurately examined by using a vacuum tube of special construction. From a field of 18,000 gauss upward, the lines composing the nonet were distinctly observed with my instrument. They are distributed in three groups of three lines each, closely arranged at equal intervals, and each group occupies the position of the normal triplet. No dissymmetry with respect to the middle line was noticed. Several measurements in fields between 18,000 and 28,000 showed that the separation of lines in each group is proportional to the field strength, so that in weak fields each group appears as a single line. The lines of the middle group are equally bright, but the intensity of the remaining two groups of lines diminishes as we proceed outwards, just as is the case with the mercury line 5461, which is also divided into

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